NASA Ames Intelligent Mechanisms Group

http://img.arc.nasa.gov


Objective

The objective of the Intelligent Mechanisms Group (IMG) is to develop and advance the technology of planetary and space-based robotic systems. Our focus is on supervised autonomy, so we develop robot architectures and operator interfaces appropriate to this level of telerobotic control. Our research is grounded by building intelligent mechanisms and then testing them in realistic field experiments.
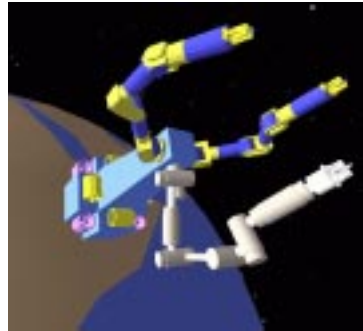
Research

The IMG's approach is driven by the importance of telerobotic technology to NASA missions, in three specific areas: (1) the safe and fault tolerant movement of robotic devices; (2) the efficient and intuitive control of remote systems; and (3) construction and exploration tasks on planetary surfaces. Using terrestrial vehicles as analogs to space vehicles is fundamental to our approach. Crucial to the success of intelligent mechanisms is suitable computational systems and methods for robustly evaluating and handling faults.

Operational needs in unstructured or changing environments require appropriately constructed systems architectures incorporating multiple sensor data, intelligent software and user interfacing. Therefore, our work is directed towards:

- High-performance computer processing and visualization
- Telerobotic operator interfaces incorporating telepresence and virtual environments
- Software architectures for supervised autonomy
- Visual, tactile and proximity sensor processing
- Machine learning including knowledge acquisition, neural and behavior-based control.
- Integration into demonstrable applications

The products of the IMG are advancements in the ability to accomplish NASA's mission, and these are measured by the demand for and impact of our research on our collaborators.

Field Experiments

We have performed numerous field experiment with the Marsokhod in Kamchatka,1994, Amboy crater, 1994, Kilauea volcano, 1995, and the Painted Desert, 1996; and with the TROV subsea robot in Antarctica, 1992, and Mono Lake, 1995.

Collaboration

The IMG collaborates with NASA centers, universities, and research labs to integrate our work into other robotic systems. We collaborated with Carnegie Mellon University for the Dante II descent into Mount Spurr, Alaska, 1995, and will work together again to control the Nomad robot in Atacama Desert of Chile. We continue to support the University of Maryland's Ranger development and ongoing projects at Stanford University.

Ames Intelligent Mechanisms Group